DOCUMENT RESUME

ED 442 483 JC 000 405

AUTHOR Comerford, Sandra Stefani; Busk, Patricia L.; Roberts, William L.

TITLE Epistemological Beliefs of Community-College Students.

PUB DATE 2000-04-25
NOTE 11p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 24-28, 2000).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Development; *Community Colleges; *Course Organization; Critical Thinking; *Epistemology; Instructional Effectiveness; Student Motivation; *Teacher Student Relationship; Teaching Methods; *Two Year College Students; Two Year Colleges

ABSTRACT

To date, no studies have focused solely on community college students' epistemological beliefs and the courses students pursue. The purpose of this study was to determine if a semester-long community-college course designed to increase critical thinking skills could help students attain more sophisticated levels of epistemological beliefs. A secondary purpose of this study was to examine the relation between teachers' epistemological beliefs and the resulting epistemological beliefs of their students. The results did not support the research questions. Neither the course nor the teachers' level of epistemological beliefs was found to relate to students' epistemology. These implications help identify classroom practices that increase student success in college. One possible way for instructors to identify effective classroom practices is to link their teaching goals to classroom assessment. Also effective for instructors interested in increasing students' epistemological beliefs is the importance of instructor feedback to students. In addition, instructors can construct tests and assignments that foster integration of knowledge. Specific discussions and written self-reflections about epistemology among teachers and students can, at the very least, make students aware of their beliefs. Teachers also need to be aware of the forces impeding higher-order thinking skills, evaluation and integration of knowledge, pressures such as grades and coverage of course materials. (Contains 25 references.) (VWC)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 442 483

Epistemological Beliefs of Community-College Students

Sandra Stefani Comerford, Patricia L. Busk,

and William L. Roberts

University of San Francisco

A paper presented at the annual meeting of the

American Educational Research Association

New Orleans, LA

April 25, 2000

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

S. Stefani Comerford

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Purpose

Since the 1980s, researchers have examined metacognitive awareness or strategies that students possess in the college classroom, and the results of their investigations clearly show the benefits of metacognition—benefits that have resulted in higher test grades, greater comprehension, and higher grade point averages (GPA). Schema theory and metacognition, however, have not answered all questions about student learning, particularly questions that ask why some students do not monitor their comprehension or why some fail to integrate information. Some of these perplexing questions may be answered through the study of epistemological beliefs.

Personal epistemology or epistemological beliefs identify what students believe about the nature of knowledge and learning. Indeed, research evidence now indicates that more sophisticated levels of epistemological beliefs do influence academic performance in a positive way (Dweck & Leggett, 1988; Ryan, 1984a, 1984b; Schoenfeld, 1983, 1985; Schommer, 1990). More sophisticated levels of epistemological beliefs result in better academic performance. For example, if students believe that knowledge is related and not composed of isolated bits of information, they then will attempt to link their knowledge, thus resulting in a comprehensive understanding.

Researchers in a number of studies have analyzed college students' epistemological beliefs; however, to date, no studies have focused solely on community-college students and the courses they pursue. Those community-college instructors whose purpose is to instruct students to develop more integrated, higher-order thinking skills should be helping students progress toward more sophisticated levels of epistemological development, which is necessary because epistemological beliefs do influence academic performance. Evidence of possible links between course structure and epistemological beliefs may suggest ways college instructors can help students be successful in college.

In addition to this study's relevance to the theory of epistemological beliefs, evidence strongly suggests that more sophisticated levels of epistemological beliefs increase academic success. Community colleges attract many diverse students, and increasing their academic success is an important goal for those instructing at these institutions. A large proportion of higher education students attends community colleges, and many receive certificates, attain associate degrees, or transfer to 4-year colleges and universities to receive bachelor degrees. Academic success ensures community-college students' achievement of these goals and future jobs; therefore, investigating more sophisticated levels of epistemological beliefs in a course is relevant in relation to these students' academic success.

It was unknown whether aspects of a course affect epistemological beliefs; therefore, the purpose of this study was to determine if a semester-long community-college course designed to increase critical thinking skills could help students attain more sophisticated levels of epistemological beliefs. A secondary purpose of this study was to examine the relation between teachers' epistemological beliefs and the resulting epistemological beliefs of their students.

Theoretical Framework

The theoretical basis of this study is based on William Perry, Jr.'s (1968) theory of college students' beliefs about the nature of knowledge. His theory outlined a series of nine intellectual stages through which students progressed. Succinctly summarized, the Perry Scheme (1970) identified that the lowest level of intellectually mature students believed that knowledge, viewed as either right or wrong, was comprised of absolute truths and was an accumulation of facts received from authorities, such as teachers. In time, students acknowledged the diversity of points of view but continued to search for the right answer. Students proceeded from these lower stages to higher stages, the most complex involving students' beliefs that knowledge derived through reason was comprised of multiple points of view and was more tentative in nature; ultimately, they would need to make personal decisions among competing versions. The Perry Scheme set the theoretical groundwork for

researchers interested in examining personal epistemological beliefs in various disciplines, including education.

Since 1980, epistemological beliefs have been investigated to determine if these beliefs could be an underlying mechanism of metacognition (e.g., Ryan, 1984a; Schoenfeld, 1983, 1985; Schommer, 1990; Schommer, Crouse, & Rhodes, 1992). Indeed, evidence now indicates that more sophisticated levels of epistemological beliefs result in better academic performance (Dweck & Leggett, 1988; Ryan, 1984b; Schoenfeld, 1983, 1985; Schommer, 1990). Schommer has found statistically significant correlations between some of these dimensions of epistemological beliefs and test performance (Schommer, 1990), indirect effects between epistemological beliefs and academic performance (Schommer, Crouse, & Rhodes, 1992), and possible effects between beliefs about knowledge and study strategies (Schommer, 1993a, 1993b). For example, if students believe that knowledge is related and not composed of isolated bits of information, they then will attempt to link their knowledge, thus resulting in a comprehensive understanding and better academic performance.

Since Perry's seminal work, the relationship between epistemological beliefs, strategy use, and academic performance has progressed, Schommer (1990) furthered the investigation of epistemological beliefs in the early 1990s by challenging the concept that epistemological beliefs were unidimensional and by proposing instead that they were composed of four independent dimensions: fixed ability, quick learning, simple knowledge, and certain knowledge[1]. Using a more quantitative approach, Schommer developed a 63-item, Likert-scale questionnaire to assess epistemological beliefs. The questionnaire permitted a means to collect a large amount of data, thus allowing for extensive quantitative assessment. Yet, Schommer has been criticized for the absence of confirmatory factor analysis on the entire list of 63 items (Hofer & Pintrich, 1997). Having grouped the 63 items in 12 subscales, Schommer has used only the 12 subscales as variables for the factor analysis that resulted in 4 factors; the items in these subscales have not been verified empirically. In a 1995 study with secondary students, efforts to factor analyze the items on the questionnaire resulted in a three-factor model based on only 32 items (Qian & Alvermann, 1995). My own work (Comerford, 1999) with factor analysis of Schommer's Epistemological Questionnaire, as explained in the Instrument section below, has shown that a number of items on this instrument did not aid in measuring this construct. Using Rasch scaling to determine the elimination of items produced a 34-item questionnaire.

The Treatment

The treatment was a semester-long 3-unit Advanced English Composition course, a sophomore-level course designed for students who have completed successfully the first-year, transfer-level freshman composition course. Although each instructor is allowed flexibility in designing and teaching the course and in selecting their own texts and assignments, a common course outline with course objectives sets the standards and required course outcomes that every instructor teaching the course must follow. This course fulfills the critical-thinking requirement for transfer students to the California State University system and the University of California system.

In addition to teaching composing skills necessary for good essay writing, the instructors in this course emphasize critical-thinking skills that include formal instruction in principles of inductive and deductive reasoning, the relationship of language to logic, common logical fallacies, and methods of analysis and evaluation. Therefore, the class focus includes examining diverse points of view and evaluating, through critical analysis, the accuracy, relevance, and quality of ideas, information, evidence, and arguments in the writing of others as well as in the students' own writing. Students learn to identify and differentiate among facts, inferences, assumptions, and claims. Students are introduced to overgeneralization, evasion of relevant questions and evidence, counterarguments, weak or erroneous premises, and fallacious conclusions. Students in the Advanced English Composition classes examine several topics in depth. But rather than

---

[1] Fixed ability is a concept identifying ability as a fixed entity or as an incremental one with the possibility of improvement. Quick learning indicates a continuum that at one end states that learning happens quickly or not at all and, at the other end, that learning is gradual. The continuum of simple knowledge labels knowledge as isolated bits or as highly interrelated concepts. The range of certain knowledge extends from the belief that knowledge is absolute to knowledge is tentative.

acquiring this knowledge as isolated bits, students are urged to interrelate concepts, for good papers produced in these classes must analyze and synthesize information. Such activities are designed to encourage students to abandon a belief in simple knowledge. In addition, the critical-thinking focus in these courses requires students to evaluate accuracy, evidence, and strength of ideas, ideas that are often contradictory. As students become acquainted to writers' different opinions and beliefs and discuss these opposing views, frequently opinions of experts in a field, students should become more aware of the tentative nature of knowledge, thus creating a situation for abandoning their belief that knowledge is absolute. Thus, the course content should help students to abandon such beliefs, helping them achieve more sophisticated levels of epistemology.

Methodology

This study used a pretest-posttest experimental design with a comparison group to determine if a 18-week, semester-long course program could contribute to increased epistemological beliefs and also if teachers' own epistemological beliefs related to the resulting epistemological beliefs of their students. The sample for this study was students attending a midsize suburban San Francisco Bay Area community college, part of the California state system of higher education, and representing a wide range of abilities and educational preparation as well as age and socioeconomic levels. Data from 476 matched questionnaires from the pre- and postadministration during Fall 1998 semester were used to address the major and minor research questions. Of this number, 196 were from the intervention group comprised of students enrolled in 18 Advanced English Composition classes, taught by 15 English instructors and designed to increase students' critical thinking and ability to integrate knowledge. The remaining 280 cases were from the comparison group comprised of students in 20 sophomore-level classes taught by 17 instructors in various disciplines: accounting, biology, chemistry, French, mathematics, music, physics, psychology, Spanish, and speech.

Both students and teachers completed the Schommer Epistemological Questionnaire. In addition, students filled out a simple demographic questionnaire. Schommer's questionnaire was administered to students at the beginning and end of the semester, whereas teachers filled out the questionnaire only at the beginning of the semester.

The major research question was tested by using a one-way repeated measures analysis of variance for student data. Correlation coefficients were computed between teacher beliefs and change in student beliefs to address the secondary question.

Instrument

Because more sophisticated levels of epistemological beliefs result in better academic performance, measuring these beliefs is a useful tool to help students academically. Schommer's Epistemological Questionnaire has allowed for extensive quantitative assessment. Yet, a pilot test of the instrument resulted in poor reliability and problems with factor structure. Indeed, research has shown that a number of items on Schommer's Epistemological Questionnaire did not aid in measuring this construct. Other researchers (Bendixen, Dunkle, & Schraw, 1994; Qian & Alvermann, 1995) who have used this instrument and have performed factor analyses at the item level, at times with inadequate sample sizes, both with high-school and college populations, have reduced the number of items substantially and uncovered three- and four-factor structures. This research is no exception, yet a substantial difference between this study and prior studies using the epistemological questionnaire lies in the factor structure. Factor analysis (Comerford, Busk, Roberts, & Blumberg, 1999) of the items resulted in three factors, explaining only 27.9% of the variance and showing poor test-retest reliability. Based on these poor findings, Rasch scaling procedure (Wright & Masters, 1982) was used to obtain a better measure of epistemological beliefs. Thus, for this study, the elimination of 29 items was based on Rasch scaling, not factor analysis, as in other studies. Rasch scaling allowed the items and cases to be calibrated separately, producing a sample-free scale. The reliability of internal consistency for the remaining 34 items was good (alpha = .84). Overall test-retest reliability for the entire 34-item questionnaire was reported as .61 (Comerford, Busk, Roberts, & Blumberg, 1999), and thus, it was the revised instrument as a whole that was used to assess students' epistemological beliefs rather than the three factors.

Two data sets (n = 170) of upper-division teacher education majors enrolled at a university that is part of the Minnesota State Colleges and Universities system were used to assess validity evidence. Lower scores on the epistemological questionnaire, indicating more sophisticated levels of

epistemology, correlated with higher grade-point-averages and higher scores on the reading and writing components of the Pre-professional Skills Test, thus associating academic achievement with more sophisticated levels of epistemological beliefs. In addition, a comparison between the total scores for the teacher and the average total score for the students in their classes on the epistemological beliefs questionnaire revealed a statistically significant difference (Paired t test = 3.42, df = 27, $p < .002$, ES = .87). The Rasch-scaled teacher scores ranged from 37.78 to 56.70, with only 19.1% of students having more sophisticated epistemological beliefs than the teacher with the highest score. The fact that less than a quarter of the students had more sophisticated levels of beliefs than the teacher with the lowest level of beliefs, which was 56.70, provided validity for the hypothesis that those who have greater educational experience, such as teachers, demonstrate more sophisticated levels of epistemological beliefs than their students with less experience (Comerford, Busk, Roberts, & Blumberg, 1999).

This instrument assessed an unidimensional construct and did not support the hypothesis of independent dimensions of epistemological beliefs, as proposed by Schommer (1990). The absence of multidimensional aspects supported Perry's (1968) initial conception of college students' beliefs about the nature of knowledge. The Perry Scheme outlined nine intellectual stages through which students progressed, all within one construct of epistemology. Thus, the newly revised 34-item, Rasch-scaled epistemological questionnaire proved useful in assessing college students' and teachers' epistemological beliefs. The reliability and validity evidence of this instrument as a whole was adequate, and the results of this measure gave an overview of students' epistemology.

Results

The results did not support the major or minor research questions. Neither the course nor the teachers' levels of epistemological beliefs were found to relate to students' epistemology.

After testing for homogeneity of population variances, a repeated measures ANOVA was used to test the effectiveness of the treatment for the major research question. Means and standard deviations for each group—intervention and comparison—from the pretest and posttest are shown in Table 1.

Table 1

Means and Standard Deviations for Each Group from the Pretest and Posttest of the Epistemological Questionnaire

		Pretest		Posttest		Difference	
Groups	n	M	SD	M	SD	M	SD
Intervention	196	51.75	6.05	52.32	5.10	0.57	5.58
Comparison	280	51.44	7.19	52.88	5.28	1.44	6.24
Total	476	51.56	6.74	52.65	5.21	1.09	5.98

There was no statistical difference between the means of the two groups; standard deviations also were similar. Furthermore, there was no statistically significant difference in the interaction between time (pretest administration and posttest administration) and the two groups, as determined by the composite score on the 34-item epistemological questionnaire. Yet, there was a statistically significant difference in change over time regardless of group ($F(1,474) = 13.28$, $\eta^2 = .03$). Therefore, there was a difference between the pre- and posttest means; however, the measure of strength of relationship was small. Also, a close scrutiny of the change in direction within both groups revealed a change primarily in the direction which indicated less sophisticated beliefs.

Therefore, for the major research question, both the intervention and comparison groups performed similarly on the pre- and postadministration of the revised epistemological questionnaire. The strength of relationship for the statistically significant differences in change over time for the entire sample and for the comparison group was small; in addition, the direction of change did not indicate more sophisticated epistemological beliefs for students.

For the minor research question, an analysis of the ANOVA data indicated that there was a statistical difference between student mean change in scores and the teachers' scores on the epistemological beliefs questionnaire ($F(19, 426) = 1.83$, $\eta^2 = .08$); however, the strength of

relationship was small. Also an examination did not reveal a consistent change in students' epistemological beliefs to more sophisticated levels based on those teachers with higher epistemological beliefs. In other words, some teachers with higher epistemological beliefs had students' epistemological belief change to less sophisticated levels, whereas some teachers with less sophisticated epistemological beliefs had students' mean scores shift to more sophisticated levels of epistemological beliefs.

A similar analysis separating the intervention and comparison group resulted in no statistical difference between teachers' epistemological belief scores and mean changes in student scores for the intervention group, but a statistically significant difference for the comparison group ($F(13,241) = 2.22$, $\eta^2 = .11$). Yet, the change was primarily in the undesirable direction, indicating a change in students' beliefs to less sophisticated levels.

Thus, teachers' own epistemological beliefs did not relate to an increase in the level of their students' epistemological beliefs. Although a statistical difference resulted between student mean change in scores and the teachers' scores for the entire sample and for the comparison group, the change was not progressively toward more sophisticated levels of epistemological beliefs for students; indeed, in many instances, students' scores indicted less sophisticated levels of epistemological beliefs. Despite teachers' considerably lower scores on the epistemological questionnaire, indicating more sophisticated levels of epistemological beliefs than their students, students did not achieve consistently more sophisticated belief levels.

Limitations of the Study

The results of the study were limited by several factors. First, the subjects of the study were selected from one community college in California. Although socioeconomically and ethnically diverse, the sample was selected from sophomore-level courses in a college located in an affluent county very close to a large urban city. Even though other community colleges share a similar population, not all community colleges in California, much less the United States, have similar qualifying factors. In addition, students in these sophomore-level classes represent only one segment of students attending community colleges in general. Because the classes used in this study are advanced classes, students with intentions of transferring to 4-year colleges and universities usually enroll in these classes, thus excluding, for example, community-college students in remedial classes or those attending for self-enrichment. Therefore, the generalizability of the results is limited.

A second limiting factor is the control of the instruction in the Advanced English Composition classes. Although all the instructors were qualified and had the requisite skills to teach this course and, based on the Instructor Course Report, a survey designed for this study which required faculty to identify course objectives and methodology, seemed knowledgeable of the goals and outcomes of this specific course, instruction that took place in each class was not monitored. The Instructor Course Report, completed by the instructors, perhaps captured their perceptions rather than reality, and as such this self-report was not monitored externally. This lack of control did not allow for an objective evaluation based upon well defined criteria of the instruction in these intervention classes.

Another limitation involves the nature of any study that attempts to determine change in students for one class. Students are influenced by many factors including the class used as a treatment in this study. Although students completed the epistemological questionnaire twice in the same class, they were not instructed to complete the questionnaire only considering that one class in which they were completing the questionnaire. Thus, their responses on the questionnaire reflected influences on their beliefs from many various sources.

A final limitation is the instrument used to assess epistemological beliefs. To accept the research conclusions, the questionnaire must be accepted as a valid and reliable measure. Beliefs about learning and knowledge are difficult constructs to measure. Researchers have used interviews and ratings to students' responses as well as questionnaires to assess this elusive construct. Much work was done on Schommer's original epistemological questionnaire for this study to produce a sound instrument; nonetheless, an underlying assumption remains: can an instrument such as a questionnaire measure beliefs about learning and knowledge?

Discussion

To date the finding of studies on epistemological beliefs indicate a need to consider epistemological beliefs in the classroom. Student improvement in academic performance is a concern for all institutions of higher education, especially for community colleges, which have open-door policies for admission. Schommer has urged that community colleges (1993b) and teachers (1993a) consider assessing their students' epistemological beliefs. Ryan (1984b) has advocated for future research concerning naive epistemologies and the issue of instructional effectiveness. Lyon (1990) recommended systematic identification of epistemological perspectives of teachers and students, and Beers (1988) has emphasized the influence between teachers' conception of knowledge and their daily activities in the classroom. This study attempted to address some of these concerns and contribute to this body of knowledge.

Investigating college students' epistemological beliefs, Paulsen and Wells (1998) found differences across major fields of study and, thus, concluded that students' beliefs about the nature of knowledge and learning were related to their specialized course-work within their discipline. They speculated that relationships among abstract concepts, characteristic of pure fields (e.g., physics), might encourage majors in this discipline to view knowledge as a gradually evolving set of interrelated ideas, whereas students majoring in applied fields (e.g., engineering, business and education) might view knowledge as definitive and absolute. It would seem, then, that academic departments might need to consider their instructional environments and analyze whether they are conducive to the development of more sophisticated epistemological beliefs. This area seems worthy of more research in future studies.

This study addressed the issues of students' epistemological beliefs in relation to a classroom intervention and teachers' epistemological beliefs. The implications of this study lead to the difficult, but necessary, identification of classroom practices that increase student success in college. Understanding epistemological beliefs may give teachers a tool with which they can assess their classroom practices. One possible way for instructors to identify effective classroom practices is to link their teaching goals, which for most community-college faculty reflect more sophisticated levels of epistemological beliefs, to Classroom Assessment (Angelo & Cross, 1983). Classroom Assessment comprises useful techniques that help college teachers obtain feedback from students about their learning. Teachers can use these formative evaluations to inform their teaching and improve their students' learning and to address, directly or indirectly, their students' epistemological beliefs. Teachers may even want to provide instruction in beliefs about the nature of knowledge and learning.

Also effective for instructors interested in increasing students' epistemological beliefs is the importance of instructor feedback to students. Teachers' written and oral feedback can be modified intentionally to encourage students to think critically, to force students to experience a moderate level of dissonance, and to invite them to construct their learning (McKeachie, 1994). In addition, instructors can construct tests and assignments that foster integration of knowledge (Haladyna, 1994). Students can be helped to generate their own questions that encourage critical thinking (King, 1995). Specific discussions and written self-reflections about epistemology among teachers and students can, at the very least, make students aware of their beliefs.

Therefore, teachers consciously must align their goals of improving their students' higher-order thinking skills with their feedback and classroom practices. In addition, teachers need to be aware of the general level of their students' epistemological beliefs, for it is this awareness that can guide teachers in assisting students to reach more sophisticated levels. Thus, when students tell teachers that they studied incorrectly or that they do not know what the teacher wants, teachers may be more sensitive in guiding these students, drawing upon their knowledge of the process students must undergo to develop more sophisticated levels of epistemological beliefs, a process that must be learned.

Teachers also need to be aware of the forces impeding higher-order thinking skills and evaluation and integration of knowledge, pressures such as grades and coverage of course materials. Students' apprehension of receiving an unfavorable grade increases in situations that do not provide clear-cut, definitive answers, answers that have been delivered by the teacher and regurgitated in an exam by the students. Also pressure to cover a substantial amount of information leaves little time in class to address the integration of information. Again the underlying, unintentional message of teachers to students is the importance of many facts and their memorization. Aware of these conflicting pressures, teachers need to reconcile them in an appropriate way for their discipline and

teaching. Although solutions may be specific to disciplines, teachers can model how they themselves link knowledge and see connections between ideas, allowing students to witness a process approach to analyzing problems within a discipline. Teachers can devise course activities that are designed to help students integrate information. Also teachers can encourage students to assess skills in analysis and critical thinking by using classroom assessment techniques advocated and described in detail by Angelo and Cross (1983), techniques such as the Categorizing Grid; Defining Features Matrix; Pro and Con Grid; Content, Form, and Function Outlines; and Analytic Memos.

Paulsen and Feldman (1999) found that motivation of students to learn is related to their epistemological beliefs. If this is the case, when teachers construct learning environments to increase epistemological beliefs, they also will be increasing student motivation. Techniques suggested above, along with other methods such as ill-structured problems, can promote more sophisticated levels of epistemological beliefs, provided that teachers design such environments that encourage students to find possible solutions, make connections, and apply and analyze different contexts, and not penalize them for not producing the one solution. Faculty members are not only the experts in their respective disciplines but also the creators of instructional and motivational environments, enhanced by their understanding of student epistemological beliefs.

Although the results of this study do not support the intervention of the transfer-level Advanced English Composition course or teachers' own levels of epistemological beliefs as having a relation to positive changes in students' epistemological beliefs, teachers' own epistemological beliefs are higher on average than students' epistemological beliefs, indicating that maturation and educational level influence these beliefs. Thus, epistemological-belief levels do change, and teachers have been successful students themselves beyond their undergraduate studies; these results have implications for student success in higher education, especially for students in community colleges. Future research might examine interventions in which epistemological beliefs are addressed explicitly for both teachers and students. Making assumptions explicit may affect quicker changes in students' epistemological beliefs. Or a group of students can be followed over time with numerous measures to determine when changes occur and, when they do, what factors have contributed to the changes. Qualitative research methods, such as a think-aloud protocols or focus groups, can be incorporated in the design to gather rich data from students, information that cannot be captured with a Likert-type survey alone. In addition, subsequent studies also might investigate the influence of teachers' epistemological beliefs on their educational objectives and classroom practices, perhaps uncovering essential links that promote more sophisticated levels of epistemological beliefs.

At the moment, the revised 34-item, Rasch-scaled epistemological questionnaire is useful in assessing college students' epistemological beliefs. The reliability and validity of this instrument as a whole are adequate, and the results of this measure give an overview of students' epistemology. Used by either instructors or student-services personnel, this questionnaire will yield data that have reliable and valid evidence in order to assess and discuss epistemological beliefs with students.

References

Angelo, T. A., & Cross, K. P. (1983). *Classroom assessment techniques: A handbook for college teachers*. San Francisco: Jossey-Bass.

Beers, S. E. (1988). Epistemological assumptions and college teaching: Interactions in the college classroom. *Journal of Research and Development in Education, 21*, 87-94.

Bendixen, L. D., Dunkle, M. E., & Schraw, G. (1994). Epistemological beliefs and reflective judgment. *Psychological Reports, 75*, 1595-1600.

Comerford, A. S. (1999). The effects of a critical-thinking component in an English composition course on the epistemological beliefs of community-college students. (Doctoral dissertation, University of San Francisco, 1999). *Dissertation Abstracts International*, 9926652.

Comerford, S. S., Busk, P. L., Roberts, W. L., & Blumberg, C. J. (1999, April). *Assessing epistemological beliefs of community-college students*. Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Canada.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*, 256-273.

Haladyne T. M. (1994). *Developing and validating multiple-choice test items.* Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67* (1), 88-140.

King, A. (1995). Inquiring minds really do want to know: Using questioning to teach critical thinking. *Teaching of Psychology, 22*, 13-17.

Lyons, N. (1990). Dilemmas of knowing: Ethical and epistemological dimensions of teachers' work and development. *Harvard Educational Review, 60*, 159-180.

McKeachie, W. J. (1994). *Teaching tips*. Lexington, MA: D. C. Heath & Co.

Paulsen, M. B., & Feldman, K. A. (1999). Student motivation and epistemological beliefs. In M. Theall (Ed.), *Motivation from within: Approaches for encouraging faculty and students to excel* (pp. 17-25). San Francisco: Jossey-Bass.

Paulsen, M. B., & Wells, C. T. (1998). Domain differences in the epistemological beliefs of college students. *Research in Higher Education, 39*, 365-384.

Perry, W. G., Jr. (1968). *Patterns of development in thought and values of students in a liberal arts college: A validation of a scheme.* Cambridge MA: Bureau of Study Counsel, Harvard University. (ERIC Document Reproduction Service No. ED 024 315)

Perry, W. G., Jr. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. New York: Holt, Rinehart and Winston.

Qian, G., & Alvermann, D. (1995). Role of epistemological beliefs and learned helplessness in secondary school students' learning science concepts from text. *Journal of Educational Psychology, 87* (2), 282-292.

Ryan, M. P. (1984a). Conceptions of prose coherence: Individual differences in epistemological standards. *Journal of Educational Psychology, 76*, 1226-1238.

Ryan, M. P. (1984b). Monitoring text comprehension: Individual differences in epistemological standards. *Journal of Educational Psychology, 76*, 248-258.

Schoenfeld, A. H. (1983). Beyond the purely cognitive: Belief systems, social cognitions, and metacognitions as driving forces in intellectual performance. *Cognitive Science, 7*, 329-363.

Schoenfeld, A. H. (1985). *Mathematical problem solving*. San Diego, CA: Academic Press.

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82*, 498-504.

Schommer, M. (1993a). Comparisons of beliefs about the nature of knowledge and learning among postsecondary students. *Research in Higher Education, 34*, 355-370.

Schommer, M. (1993b). Epistemological development and academic performance among secondary students. *Journal of Educational Psychology, 85*, 406-411.

Schommer, M., Crouse, A., & Rhodes, N. (1992). Epistemological beliefs and mathematical text comprehension: Believing it is simple does not make it so. *Journal of Educational Psychology, 84*, 435-443.

Wright, B. D., & Masters, G. N. (1982). Rating scale analysis: Rasch measurement. Chicago: Mesa Press.